



BARRIER BREAKER

Annotated Work Cited Page Due: Feb 8
 Paper Due Date: Feb 19
 Contest Due Date: March 3, 2008

In this contest you are to build the lightest, smallest, least expensive car crash barrier with the most effectiveness. You are to build your barrier out of 3"x 5" index cards and staples. The colliding vehicle is a small cart on wheels about the size of a small shoe. The vehicle's impact speed and deceleration will be monitored.

For the research paper, you are to research a topic focusing on what it takes to keep passengers safe during accidents. You can focus on trains, subways, amusement park rides, cars trucks, etc. Within this topic, you could also look at the physics, science, engineering and/or history. Your paper is to follow MLA format and citations. See the website, <http://www.mrwaynesclass.com/ResearchProject> for details and links to a few short videos explaining the parts.

Contest details

In this activity you are to build a bumper that will allow the safest possible stop in a head on impact with a wall with the lower cost to "crash rating" ratio.

$$\text{Ratio} = \frac{\text{Crash Rating}}{\text{Manufacturing Cost}}$$

Calculating the Crash Rating

$$\text{Crash Rating} = \frac{(\text{Impact Velocity})^2}{(\text{Area in centimeters}^2) + (\text{Deceleration in g's})^2}$$

Our accelerometer only goes up to 25 g's. Any acceleration greater than 25 g's will count as 50 g's. Use kinematics to figure out the minimum stopping distance or the g's to stop your actual car. Bring in your bumper and test it out.

Calculating the Manufacturing Cost

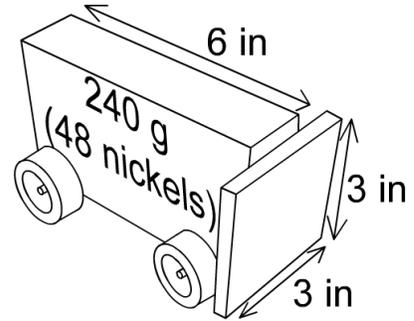
As you build your bumper keep a chart of what it takes to build it. After it complete, tally up the cost according to the table. Make sure the bumper works before cutting costs.

EXAMPLE					
Item	Cost	Reason	Tick marks each time you use this	Total Pieces Used	Total Cost
1 index card	\$3.00	Raw materials		27	\$81
Fold or curving of the paper	\$2.00	Labor cost		42	\$84
Tear or cut (any length)	\$3.00	Labor and special machinery		31	\$93
Staple	\$1.00	Material and labor to install		25	\$25
Total Cost					\$266

The Impact Test Vehicle

The vehicle colliding with the bumper is drawn to the right. It has a mass approximately equal to 44 nickels. You will be choosing the impact velocity, between 10 and 1 m/s.

This is not heavy vehicle. Its body is made from 6 inch piece of a 2"x4" piece of wood.



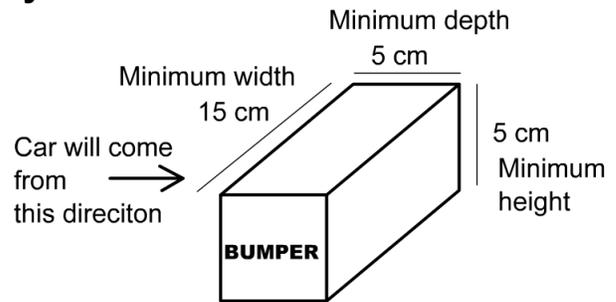
Bumper Construction

It must be made from 3 inch by 5-inch index cards. These cards can be folded, stapled, and cut. But just like in the manufacturing process, these items and procedures cost you. If your bumper uses any bigger card your "card costs" will be quadrupled to cover the cost of getting your additional resources on the black market and government fines for cheating on your forms. Your bumper must be free standing. It cannot be secured to the barrier or the floor.

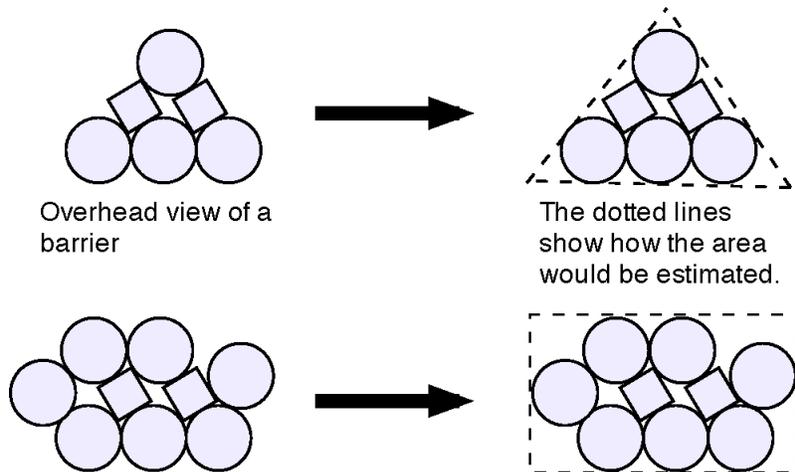
Minimum/Maximum bumper size to qualify

The impact car may or may not hit your car straight on. The car might swerve a little hit the bumper with a glancing blow. Regardless of how the car impacts the barrier, the trail still counts.

- Maximum size depth < 20 cm
- width..... < 30 cm
- height < 15 cm



Measuring the Area



We will not use any other shape to estimate the bumper's area. We will not use a combination of shapes. It is either a triangle or rectangle to estimate the area.

Breaker Barrier Contest FORM

This form is to be turned in with your barrier.

Name: _____

Partner's name: _____

FINAL				
Item	Cost	Reason	Total Pieces Used	Total Cost
1 index card	\$3.00	Raw materials		
Fold or curving of the paper	\$2.00	Labor cost		
Tear or cut (any length)	\$3.00	Labor and special machinery		
Staple	\$1.00	Material and labor to install		
Total cost of the bumper				

$$\text{Crash Rating} = \frac{(\text{Impact Velocity})^2}{(\text{Area in centimeters}^2) + (\text{Deceleration in g's})^2}$$

To be filled in by the teacher	
Area in centimeters ² :	
Impact velocity :	
Deceleration in g's :	
Crash rating:	
Scoring ratio:	

Breaker Barrier Contest Draft pages

This is your work page. It is here to help you keep track of your various build costs. Extra copies of this page may be downloaded and printed from www.mrwaynesclass.com/ResearchProject/Barrier

Try #1					
Item	Cost	Reason	Tick marks each time you use this	Total Pieces Used	Total Cost
1 index card	\$3.00	Raw materials			
Fold or curving of the paper	\$2.00	Labor cost			
Tear or cut (any length)	\$3.00	Labor and special machinery			
Staple	\$1.00	Material and labor to install			
Total Cost					

Try #2					
Item	Cost	Reason	Tick marks each time you use this	Total Pieces Used	Total Cost
1 index card	\$3.00	Raw materials			
Fold or curving of the paper	\$2.00	Labor cost			
Tear or cut (any length)	\$3.00	Labor and special machinery			
Staple	\$1.00	Material and labor to install			
Total Cost					

Try #3					
Item	Cost	Reason	Tick marks each time you use this	Total Pieces Used	Total Cost
1 index card	\$3.00	Raw materials			
Fold or curving of the paper	\$2.00	Labor cost			
Tear or cut (any length)	\$3.00	Labor and special machinery			
Staple	\$1.00	Material and labor to install			
Total Cost					